Regional climate patterns reveal themselves in the IDF curves of NOAA Atlas 14 Volume 3.

Intensity-Duration-Frequency (IDF) curves are provided through the Precipitation Frequency Data Server (PFDS) for NOAA Atlas 14 Volume 3, Precipitation Frequency estimates for Puerto Rico and the U.S. Virgin Islands. The curves are based on station data, analyzed using the regional L-moments approach. The curves have been adjusted for internal and spatial consistency. The high spatial and temporal resolution of the NOAA Atlas 14 approach reveals climatological effects not seen in previous studies. What follows is a brief climatological explanation of patterns observed in the IDF curves for your review. Figure 1 shows the station locations mentioned in this document. Note that the IDF curves in the Figures below have not been smoothed yet.

I. South coast and the central mountains

Across the south coast and the central mountains, including the southern slopes and western interior regions of Puerto Rico, tropical storms and hurricanes are the main mechanisms that produce the highest annual maximums in the 6 to 48 hour durations. Other annual maximum producing mechanisms associated with the easterly trade winds and convection do not occur with the same intensity of a hurricane at these durations. We observed in the annual maximum data sets at some stations that maximums occurred on similar date(s) (i.e., the same event) at multiple durations. The pattern of the IDF curves in these regions supports this climatology. As shown in Figure 2 (for station 66-2336, Cerro Maravilla, Puerto Rico), there is a steady increase in precipitation frequency estimates with duration until 48-hours. Then, particularly at Annual Exceedance Probabilities (AEPs) greater than 1 in 10, precipitation frequency estimates increase much more slowly from 48-hours until the 20-day duration when an increase in slope resumes.

These patterns are derived from the observed data and are driven by the climatology. For example, the patterns in the IDF curves at station 66-2336 are expected because of observed patterns in the annual maximum series at the various durations. As seen in Figure 3, the 4-, 7- and 10-day duration annual maximums are nearly identical for each year. A year-to-year variation is apparent with most maximums in these durations falling between 7 and 12 inches but with six obvious peaks that dominate the series, mostly from hurricanes occurring on 5/20/1969, 10/9/1970, 9/16/1975 (Eloise), 10/7/1985 (Isabel), 1/6/1992 (Frontal System), and 9/22/1998 (Georges). These maximum values are nearly identical at all three durations, which would result in an expected pattern of little change in precipitation frequency estimate with increasing duration.

In contrast, examination of the 30-day annual maximums (Figure 4) at 66-2336 shows a marked increase in the maximums at all years, compared with the 10-day duration, with a greater increase in the lower, non-hurricane years. This is consistent with the increase observed in the IDF curves that begins at the 20-day duration.

II. North and northwest coastal areas

Along the north and northwest coasts including sections of the northern slopes, precipitation produced during the winter months from cool frontal interactions dominates most durations of the annual maximum rainfall with convection associated with sea breeze interaction. Easterly waves are secondary. Here rainfall from most hurricanes is lessened by down slope drying flow off of the central mountains and therefore does not dominate the annual maximum series. As seen in Figure 5, the IDF curves in this region do not reflect the intense hurricane influence in the 6 to 48 hour durations.

III. Northeast interior

Across the Luquillo Mountains of the northeast interior including El Yunque, trade winds enhanced by upslope topography and convection are the dominant rainfall producing mechanisms with precipitation occurring much more often than in other regions of the Island. Tropical storms and hurricanes occur but do not dominate the annual maximum series dataset as much as in other regions of Puerto Rico. Figure 6 from this region reflects fairly uniform IDF curves throughout all durations and AEPs.

IV. U.S. Virgin Islands

The precipitation on the U.S. Virgin Islands is generated by the same mechanisms as on Puerto Rico. The smaller areal extent and smaller peak elevations somewhat limit the topographic variation in precipitation amounts compared to Puerto Rico. Precipitation from easterly waves dominates from May to November especially on the windward regions with enhancements from occasional tropical storms and hurricanes. Infrequent frontal systems create some precipitation across the Islands, mainly during the winter months. Figure 7 from this region reflects fairly uniform IDF curves.

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Ruffner, James A., 1978: Climates of the states, Vol. 2, Nebraska-Wyoming, Puerto Rico, and U.S. Virgin Islands. Detroit, MI., Gale Research Co.

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Figure 1. Station locations.

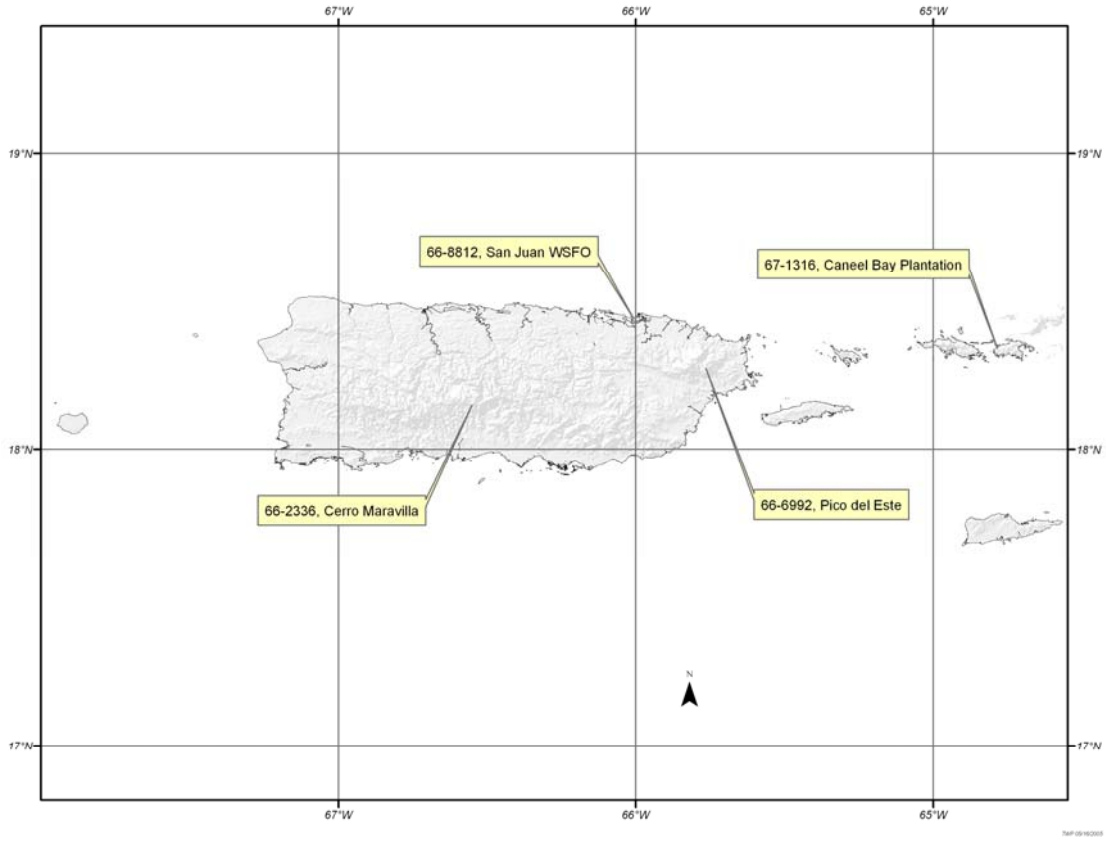

Figure 2. IDF Curves for station 66-2336, Cerro Maravilla of the central mountains.

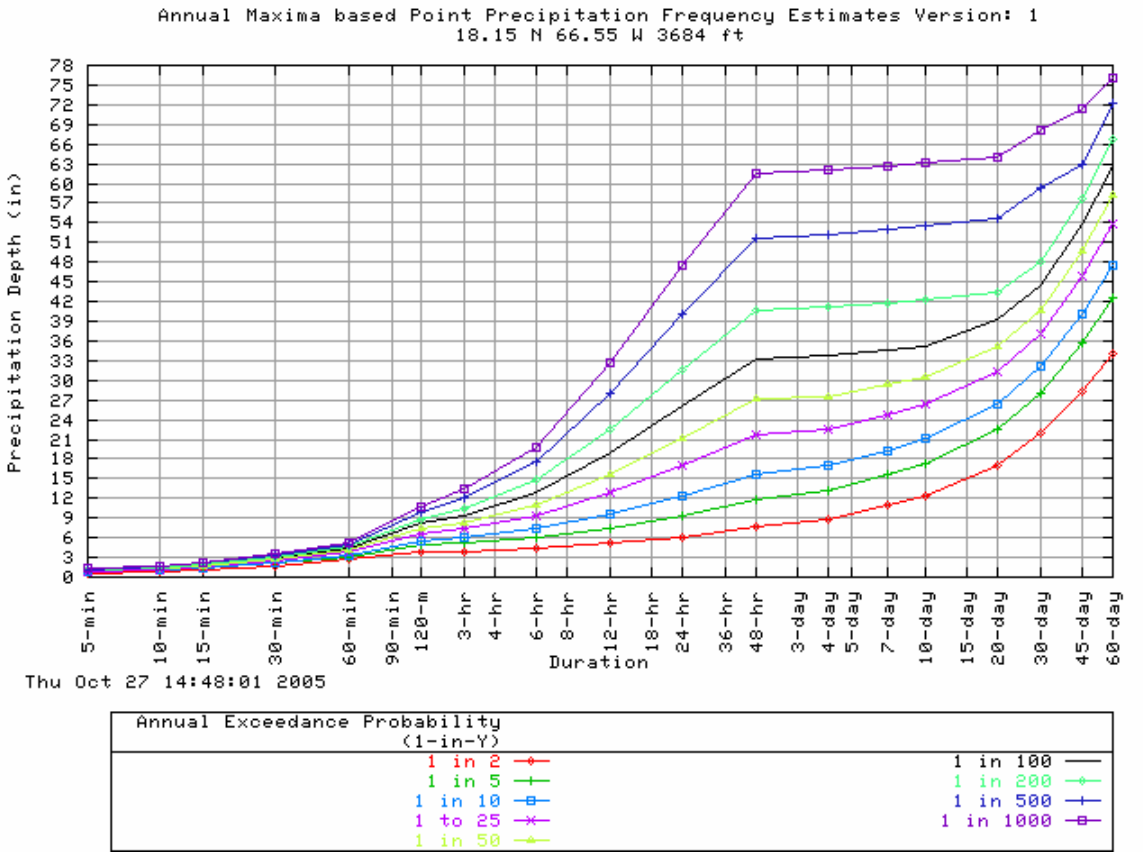

Figure 3.

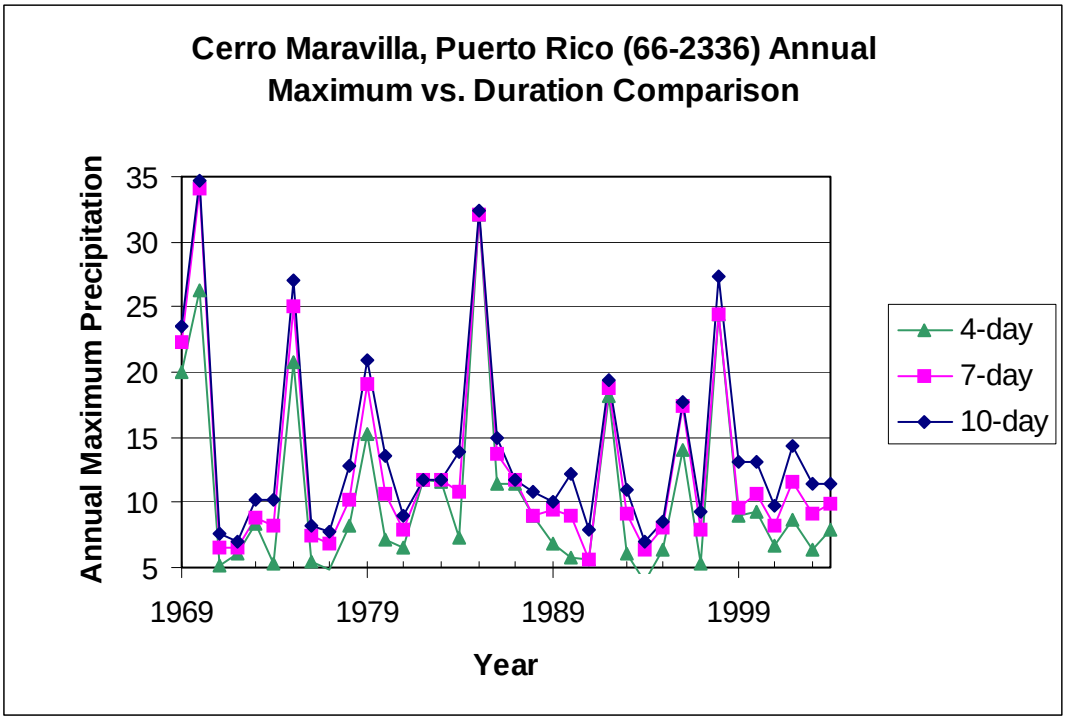

Figure 4.

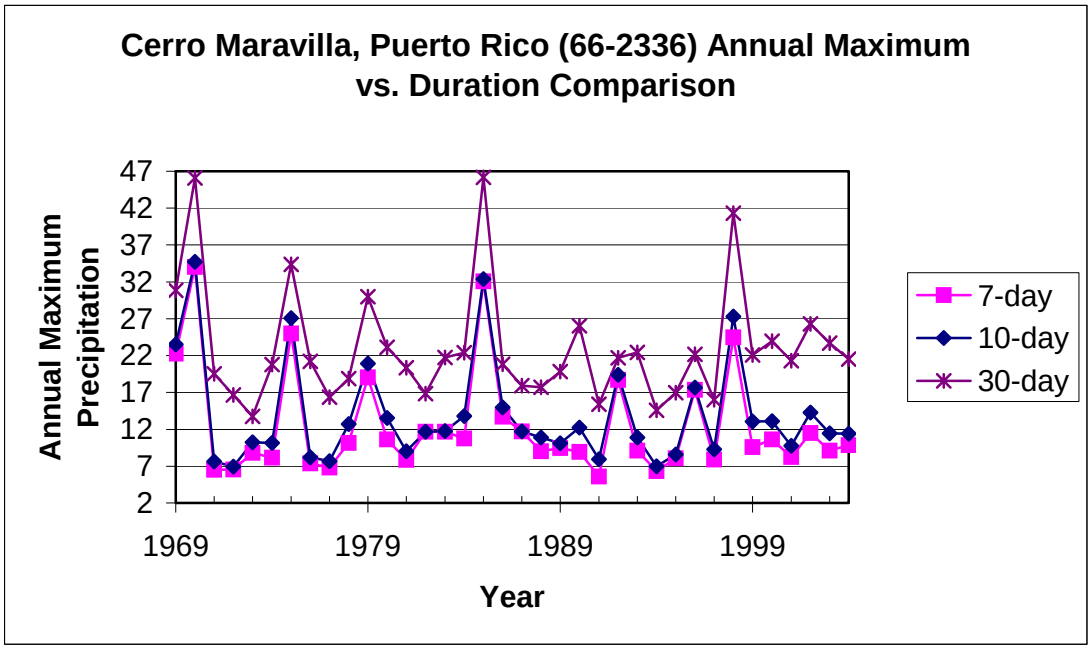

Figure 5. IDF Curves for station 66-8812, San Juan WSFO of the north coast.

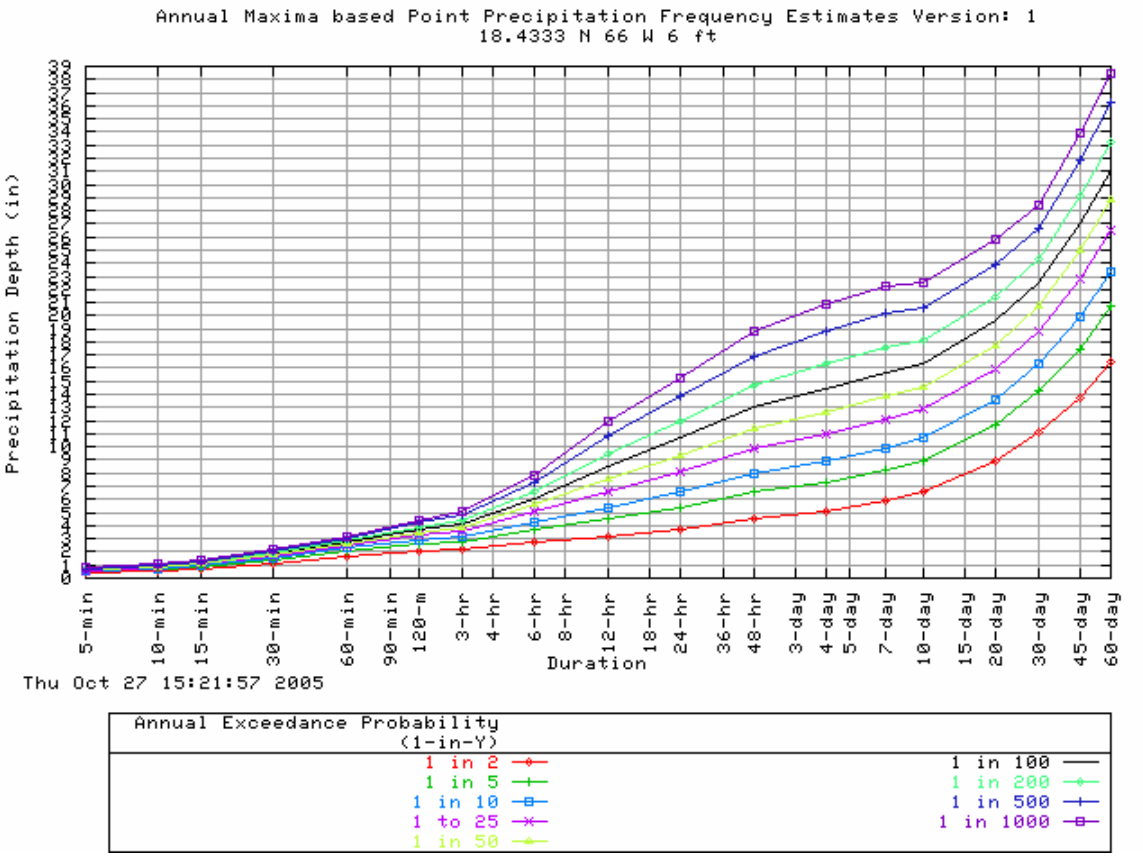

Figure 6. IDF curves for station 66-6992, Pico del Este in the northeast mountains.

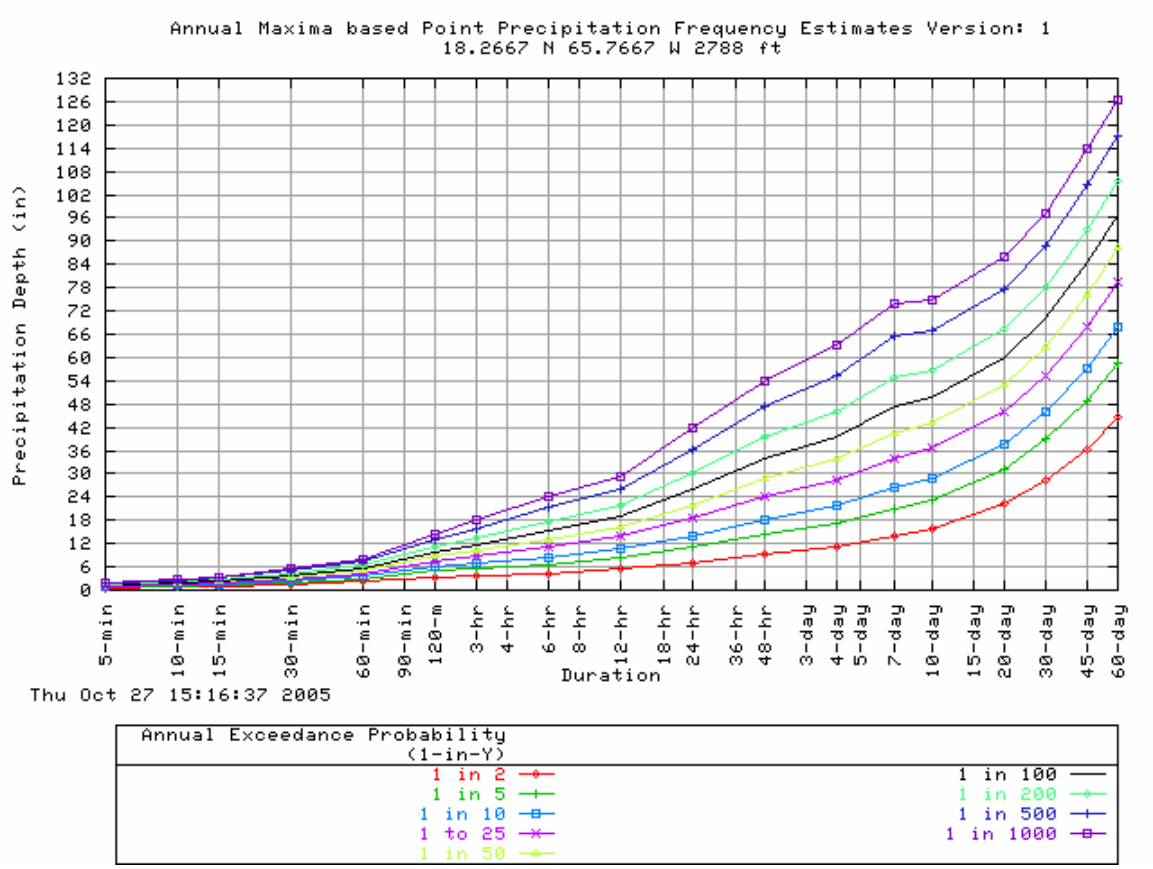

Figure 7. IDF curves for station 67-1316, Caneel Bay Plantation on the U.S. Virgin Islands.